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SYNTHETIC LUBRICATING OIL

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4 Claims. (Cl. 252—49.8)

This invention relates to synthetic lubricating compositions and particularly to synthetic lubricating oils useful for lubrication at low and high temperatures. More particularly, the invention relates to synthetic lubricating oils which have outstanding utility at low and high temperatures and which comprise blends of a branched chain alcohol ester of a dibasic acid, a complex ester, and tricresyl phosphate.

In an effort to obtain superior lubricating oils having specific and unusual characteristics made necessary by the technical developments in the last few years, new synthetic lubricants have been developed by the art. One class of materials which have attracted unusual interest as synthetic lubricants are the esters, both the simple esters and the complex type. In general, these synthetic lubricating oils are characterized by lower volatility, higher viscosity indices, and lower pour points than mineral oils of a corresponding viscosity level. Lubricants possessing such properties are of special value in the lubricating of moving parts such as combustion turbines, particularly those of the "prop jet" and "turbo-jet" type for aircraft. Mineral oil lubricants containing added viscosity index improvers, pour point depressors, or other highly non-volatile additives are undesirable for use in such engines because of their tendency to leave a residue which accumulates and interferes with the operation of the turbine. Yet it has been found that these additive materials must be added to mineral oils to give them extreme pressure resistance and viscosity characteristics essential for operating at the extreme temperature differentials experienced. The synthetic lubricants of the ester type are especially adaptable for use under such conditions since these lubricants contain no additive materials and have a desirable combination of low volatility, low pour points, and high viscosity indices.

With the continued development of aircraft engines designed to operate at peak efficiency at high altitudes it has been found that there also exists a problem of lubricity or load carrying capacity. It is with this problem of incorporation of desirable viscosity properties with lubricity or load characteristics which may be termed extreme pressure resistance in a synthetic oil blend that this invention is concerned.

It has now been found, and forms the object of this invention, that a synthetic lubricating composition having outstanding high and low temperature characteristics and outstanding extreme pressure resistance may be prepared by blending with a branched chain alcohol ester of a dibasic acid, a minor amount of a complex ester and a minor amount of tricresyl phosphate. The proportions of the resulting blend are critical and will be specifically illustrated in detail below.

As was stated above, there are three distinct components in the synthetic lubricating oil composition of this invention. They are:

(1) A branched chain alcohol ester of a dibasic acid;
(2) A complex ester; and
(3) Tricresyl phosphate.

It is to be understood, of course, that other additive materials may be added to the basic blend to further enhance the properties of the blend. For instance, oxidation inhibitors, such as phenothiazine, may be added; viscosity index improvers or pour depressants may be incorporated into the finished lubricant. In general, however, for reasons pointed out above, it is desirable to keep the amount of additive materials to a minimum and only in circumstances requiring special properties will these additive materials be included in the finished product.

A more detailed description of the component parts of the compositions of invention is set out below.

THE BRANCHED CHAIN DIESTER

The dibasic acid which is fully esterified to form the diester portion of the lubricating oil blend may be selected from sebacic and adipic acid. These acids are well known in the art and need no further description.

The branched chain alcohol which is used to form the diester of the acid is selected from a group of alcohols which contain from 6 to 16 carbon atoms in branch chain configuration. It is essential that there be some degree of branching in the carbon chain of the alcohol, and, within limits, the higher the degree of branching the more satisfactory the lubricant. Alcohols such as ethylbutyl, ethylhexyl and other well known branch chain alcohols are operable.

One group of alcohols that have recently become commercially available and that answer the requirements for the esterifying alcohol are the so-called "Oxo" alcohols. These alcohols are preferred and are contemplated in the preferred embodiment of this invention.

The Oxo alcohols are prepared by the catalytic reaction of an olefin with carbon monoxide and hydrogen. The reaction, called "Oxo" synthesis, occurs at temperatures in the order of 300° F. to 400° F. at pressures in the range of about 1000 to 3000 p.s.i. In the presence of a suitable catalyst, ordinarily a heavy metal carbonyl, such as cobalt carbonyl, there is formed an aldehyde, which is subsequently hydrogenated to a primary alcohol. This process was first developed in Germany and is described in U.S. Patent No. 2,327,066, issued to Roelen in 1943.

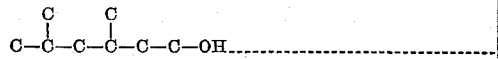
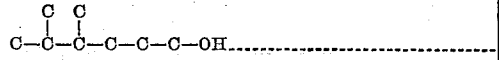
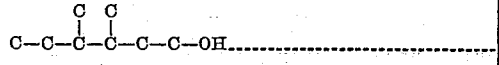
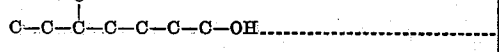
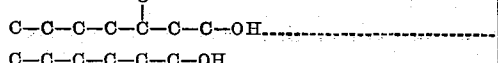
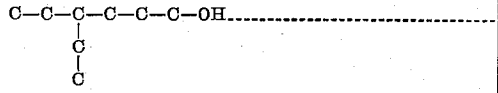
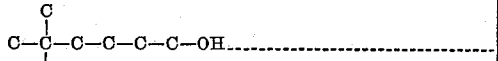
In general, the oxygenated group in a product from an olefin by the Oxo process is thought of as becoming attached to an unsaturated carbon which holds at least one hydrogen atom. In those cases where the carbon monoxide attacks a "saturated" carbon atom, it must be assumed either that that carbon has become unsaturated prior to reaction by a shift of a hydrogen atom, or that the attack is directly on a carbon atom that is truly saturated. For example, 2-butene has been reported to give 1-pentanol and 2-methylbutanol in equal quantities, a result that cannot be explained on the simple basis that oxonation takes place only on unsaturated carbons holding hydrogen. 2,3-dimethyl-2-butene also reacts giving only 3,4-dimethyl-1-pentanol; in this olefin no hydrogen is attached to the unsaturated carbon atoms, and the attack of carbon monoxide must either be on a "rearranged olefin" or on a saturated carbon atom.

It has been found that particularly desirable alcohols for the esterification of the dibasic acid to prepare the diester component of the blend of this invention may be prepared by the application of the Oxo synthesis to polymers and copolymers of C_3 and C_4 monoolefins. These monoolefins are readily available in refinery

streams and processes for their conversion to liquid copolymers have been worked out by the art. One such process, known as UOP polymerization, consists of passing the olefin-containing stream in liquid phase in contact with an acid catalyst comprising phosphoric acid impregnated on kieselguhr. Other acidic catalysts, such as phosphoric acid or copper phosphate impregnated on silica gel, sulfuric acid, Friedel-Crafts catalysts, activated clays, silica-alumina, copper pyrophosphate, etc., may be used. Suitable conditions when employing phosphoric acid catalysts of the UOP type are temperatures of 300° F. to 500° F., pressures from 250 to 5,000 p.s.i., and feed stocks comprising refinery streams containing propylene and mixed butylenes. Suitable feed stocks, for example, may contain from 15 to 60 mol percent propylenes, from 0.5 to 15 mol percent butylenes, and from 0.1 to 10 mol percent isobutylene, the remaining being saturated hydrocarbons. Other suitable feed stocks are the dimer and trimer of isobutylene.

Of the Oxo alcohols operable, those alcohols having from 6 to 16 carbon atoms are preferred. They are prepared from olefin polymers or copolymers having from 5 to 15 carbon atoms. In preparing these Oxo alcohols, the desired olefin fraction is segregated from the crude olefin polymer product by fractionation.

As was stated above, the Oxo alcohols are especially desirable esterifying alcohols because of their optimum degree of branching. For example, the following table shows the structure and percentage composition of a C_8 Oxo alcohol prepared from a C_7 olefin stream which had been fractionated from the products obtained by the phosphoric acid polymerization of refinery gas streams containing propylene and mixed n- and isobutylenes.

Structure of C_8 "Oxo" alcohol	Percent
	29.0
	25.0
	17.0
	16.0
	
	2.3
	1.4
A-alkyl-alkanols	4.3
Others	5.0
Total	100.0

It will be noted that Oxo alcohols derived from the olefins produced by C_3–C_4 polymerization are mostly methyl substituted.

Of the preferred Oxo alcohols operable as the acid esterifying agent, that is, those Oxo alcohols having from 6 to 16 carbon atoms, especially preferred are those Oxo alcohols having from 6 to 9 carbon atoms, that is, the Oxo alcohols prepared from olefins having from 5 to 8 carbon atoms. Specifically, they are the C_6 Oxo alcohol, the C_7 Oxo alcohol, the C_8 Oxo alcohol, and the C_9 Oxo alcohol.

THE COMPLEX ESTER

The second component of the synthetic lubricating compositions of this invention is generally known to the art as a "complex" ester. This material may be generally described as being the reaction product of two or more of the following compounds:

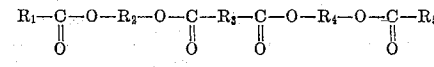
(1) Monohydric alcohols
(2) Monobasic acids
(3) Dibasic acids
(4) Glycols
(5) Polyhydric alcohols
(6) Polybasic acids

where at least one polyfunctional alcohol and at least one polyfunctional acid are employed.

These complex esters may be grouped under the following types:

Type I.—Monobasic acid-glycol-dibasic acid-glycol-monobasic acid

This complex ester may be considered to have the following structural formula:

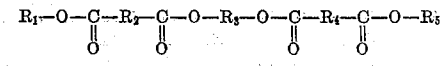


wherein R_1 and R_5 are the alkyl radicals of the monobasic acids; R_2 and R_4 are the alkyl radicals of the glycols, and R_3 is the alkyl radical of the dibasic acid.

The esters of this type may be prepared by admixing the calculated amounts of the various compounds and carrying out a straightforward esterification reaction. The reaction conditions are continued with an occasional sample of the product being tested for acidity until the minimum acidity is attained.

Type II.—Alcohol-dibasic acid-glycol-dibasic acid-alcohol

This ester, especially preferred among all the complex esters, has the following general formula:

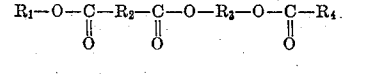


wherein R_1 and R_5 are the combining radicals of the alcohol, R_2 and R_4 are the alkyl radicals of the dibasic acid, and R_3 is the alkyl radical of the glycol.

These esters are prepared as those of Type I above but preferably they are prepared by first forming the half-ester of the dibasic acid and the glycol, and subsequently reacting two mols of such half-ester with two mols of the alcohol.

Type III.—Alcohol-dibasic acid-glycol-monobasic acid

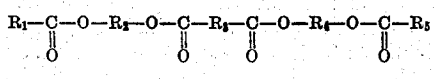
This ester may be represented by the following formula:



wherein R_1 is the alkyl radical of the alcohol, R_2 the alkyl radical of the dibasic acid, R_3 the alkyl radical of the glycol, and R_4 the alkyl radical of the monobasic acid. This ester may be prepared as described in Type I or it may be prepared by reacting a dibasic acid and a glycol under such conditions that one hydroxyl group of the glycol combines with one carboxyl group of the dibasic acid, in other words, so that a half-ester is formed. This half-ester is then reacted with a molar proportion each of an aliphatic alcohol and a monobasic acid.

Type IV.—Monobasic acid-glycol-dibasic acid-glycol-monobasic acid

These synthetic complex esters may be said to have the general formula:



wherein R_1 and R_5 are the alkyl radical of the monobasic acid, R_2 and R_4 are the alkyl radicals of the glycol, and R_3 is the alkyl radical of the dibasic acid.

It will be noted that these esters are of the same formula as those appearing above under Type I, except that this type is prepared by reacting a monobasic acid with a glycol under such conditions that a half-ester is formed, and reacting two mols of such ester with one mol of a dibasic acid.

The alcohols used in forming the esters set out above include the following: methyl, ethyl, n-butyl, n-hexyl, n-octyl, 2-ethylhexyl, cetyl, oleyl, the ether alcohols formed by the reaction of ethylene oxide or propylene oxide with aliphatic alcohols, etc. One especially suitable group of alcohols are the Oxo alcohols described in detail above.

Among the monobasic acids which may be employed in the preparation of the complex esters, the following may be listed as illustrative: acetic, propionic, butyric, valeric, capric, caprylic, pelargonic, lauric, palmitic, stearic, oleic, beta-methoxypropionic, beta-ethoxypropionic, beta-tert.-octoxypropionic, beta-ethylmercaptopropionic, beta-tert.-octylmercaptopropionic, beta-tert.-dodecylmercaptopropionic acid, and any of the various Oxo acids.

The glycols employed in preparing the complex esters referred to include ethylene glycol and any of the paraffinic homologues of the same containing up to about 18 carbon atoms. These may include, for example, ethylene glycol, propylene glycol, butylene glycol, pinacone, trimethylene glycol, tetramethylene glycol, pentamethylene glycol, and the like. Since the glycols may also contain oxygen or sulfur atoms, compounds such as diethylene glycol, triethylene glycol and the polyethylene glycols of the formula:

$$HO(CH_2CH_2O)_nCH_2CH_2OH$$

wherein n is 1 to 26 may be used. Glycols containing sulfur atoms in thio-ether linkages include such compounds as thiodiglycol and 1,2-bis(2-hydroxyethylmercapto)ethane. There also may be used glycols containing both oxygen and sulfur in similar linkages; such a compound is bis-2-(2-hydroxyethoxy)ethyl sulfide.

The preferred embodiment contemplates an ester of Type II, for instance, one that is prepared by reacting two mols of a branched chain alcohol of from 6 to 10 carbon atoms with two mols of a half ester of a dibasic acid, such as succinic, glutaric, adipic, pimelic, suberic, azelaic, or sebacic acid, and one mol of a glycol such as polyethylene glycol. Specifically preferred is the reaction product according to the above procedure of 2-ethylhexanol, adipic or sebacic acid, and a polyethylene glycol of a molecular weight of about 200.

New design "turbo-jet" and "turbo prop" engines featuring high compression ratios and increased power output have forced temperatures upward and have increased the load on gears and bearings. Oil cooling has also become a problem since bearing temperatures in excess of 450° F. are not uncommon. These factors subject the lubricant to extremely severe conditions with regard to high temperature performance and load handling ability in addition to the ordinary low temperature requirements. Lubricants designed for these engines, therefore, must exhibit an outstanding combination of physical and chemical properties.

As the temperature increases the lubricant tends to thin out or decrease in viscosity. It is essential, however, that

at the high temperature experienced the lubricant retain sufficient viscosity to furnish the lubricity necessary for decreasing friction. It has been found that in these new design engines, the viscosity of the oil at 210° F. and at 100° F. should be at least 3.0 and 11.0 centistokes respectively.

The load carrying ability of lubricants designed for these new uses must be adequate to properly lubricate the main antifriction bearings at high speeds. This is particularly true for the reduction gear assembly found in turbo prop engines. Exhaustive tests have shown that the load carrying capacity for a lubricant for this use should be such as to result in a Shell 4-Ball seizure point of about 70 kilograms and a weld point of about 120 kilograms, both values given being minimum values. The explanation of the Shell 4-Ball test is set out in detail below.

In order to prevent excessive oil consumption, the lubricant must possess a sufficiently low volatility. The ASTM flash point is used as a measure of volatility and it has been found that lubricants possessing flash points in excess of about 390° F. have been found to be satisfacory in this respect.

The viscosity of the oil at the minimum starting temperature of the engine must be sufficiently low so as to prevent serious reduction in the oil flow rate. The maximum viscosity of the oil which can be pumped in adequate quantity has been found to be about 14,500 centistokes at −65° F.

It is generally recognized, therefore, that in order to furnish satisfactory lubrication of the new design turbo jet and turbo prop engines that a lubricant should have a viscosity at 210° F. of at least 3.0 centistokes, a viscosity at 100° F. of at least 11.0 centistokes, a viscosity at −65° F. of no more than 14,500 centistokes, and a load carrying capacity sufficient to obtain a Shell 4-Ball Extreme Pressure test seizure load of about 70 kilograms and a weld load of 120 kilograms.

In order to obtain the combination of properties referred to above, the relative amounts of the three components which make up the basic formulation of this invention must be carefully selected. The limitation on amounts of the three components are critical and must be complied with as follows:

The lubricating composition must be composed of about 2% to 10% by weight of tricresyl phosphate and about 98% to 90% by weight of a blend of esters, said blend consisting of from about 85% to about 95% by volume of the dibasic acid ester and from about 5% to about 15% by volume of the complex ester.

The tricresyl phosphate, the load carrying additive, must be present in amounts between about 2% and 10% by weight based on the weight of the total composition. Increasing the complex ester and the tricresyl phosphate content above the specified limits produces no significant beneficial effect on load carrying ability and increases the low temperature viscosity beyond the level required for low temperature engine starting and operability. Decreasing the complex ester or tricresyl phosphate content will be reflected by unsatisfactory load handling ability.

The testing procedure utilized for determination of extreme pressure characteristics is the well-known 4-ball extreme pressure test developed by the Shell Development Company. This test procedure is known to the art as the "Shell 4-Ball Test."

Briefly, the test consists of the following: 3 stainless steel balls in fixed relation are contacted by a 4th ball which is rotated at high speeds. The arrangement is such that the 3 stationary balls are each contacted by the 4th rotating ball. By mechanical linkage, extreme pressures are placed on the points of contact through the rotating ball. The lubricant to be tested surrounds the points of contact. As pressure increases, it has been noted that the first pitting of the contacting surfaces occurs when the pressure is sufficient to force the lubricant from between the metal contacting surfaces. This initial pitting or

scoring, an actual seizing of the metal of the surfaces, is called the "seizure point." As pressure is increased, a point is reached at which the metal surfaces actually weld and the 4 balls become one unit. This point is referred to as the "weld point." It is to be seen that an increase in the seizure point and the weld point indicates an increase in the lubricity of the test material. Results of the test are reported in kilograms.

Various combinations of the components of the lubricating oil compositions of this invention were prepared. The viscosity properties were measured and the compositions were subjected to the 4-Ball Extreme Pressure Test. In the first series of tests, the diester used was a di-C_8 Oxo adipate. The complex ester used was the reaction product of 2 mols of a half ester of sebacic acid and 2 mols ethylhexanol with one mole of a polyethylene glycol having a molecular weight of about 200. Results of the tests on these compositions are set out in Table I below:

TABLE I

Physical data on synthetic oil compositions

[Base oil—Di-C_8 Oxo adipate.]

Lubricant No.	Makeup of Ester Blend		Wt. Percent Tricresyl Phosphate	Shell 4-Ball E. P. Test, Kg. Load—Desired Properties		Viscosity in Centistokes—Desired Properties		
	Vol. Percent Diester	Vol. Percent Complex Ester		Seiz., 70 (min.)	Weld, 120 (min.)	210° F., 3.0 (min.)	100° F., 11.0 (min.)	−65° F., 14,500 (max.)
1	100	0	0	40	95	2.88	10.10	6,812
2	100	0	3	60	95	2.84	10.26	7,912
3	100	0	5	55	95	2.87	10.36	8,679
4	100	0	10	60	100	2.87	10.67	11,282
5	100	0	20	60	100			
6	95	5	0	45	120	3.03	11.18	8,349
7	95	5	3	70	130	3.07	11.36	10,105
8	95	5	5	70	130	3.08	11.43	10,815
9	95	5	10	60	130	3.11	11.91	14,114
10	90	10	0	45	140			
11	90	10	3	70	140	3.28	12.23	12,700
12	90	10	5	75	140	3.28	12.23	13,400
13	90	10	10	70	140			
14	90	10	20	70	140			
15	65	35	0	65	140	10.26	53.6	Solid
16	60	40	5	110	140			
17	60	40	10	100	140			
18	35	65	0	60	140	4.62	18.78	38,724
19	35	65	3	75	140	4.63	18.84	42,766
20	35	65	5	85	140	4.61	18.99	48,676
21	35	65	10	80	140	4.54	19.22	50,836
22	35	65	20	80	140			
23	0	100	0	65	140	10.26	53.60	Solid
24	0	100	3	80	140	10.10	53.10	Solid
25	0	100	5	125	130	10.01	52.75	Solid
26	0	100	10	120	130	9.76	52.49	Solid

An examination of the data of Table I above shows that the incorporation of the complex ester in the lubricant increases the viscosity and the load carrying capacity of the oil. These data also show that about 10% is the maximum amount of the complex ester that can be added for optimum results considering both viscosity and load carrying capacity. Greater amounts of the complex ester do not improve the composition. The data also show that amounts of the tricresyl phosphate in excess of about 10% are unnecessary. It is interesting to note that a combination of 5% of the complex ester and 5% of tricresyl phosphate gives an extreme pressure test result which is better than would be predicted from the addition of 10% of either component.

In a second series of lubricants, combinations of the same complex ester as used above with di-2-ethylhexyl sebacate were prepared and inspected. The data show the outstanding advantage of combinations of the complex ester and tricresyl phosphate within the stated limits and are set out in Table II below:

TABLE II

Physical data on synthetic oil compositions

[Base oil—Di-2-ethylhexyl sebacate.]

Lubricant No.	Makeup of Ester Blend		Wt. Percent Tricresyl Phosphate	Shell 4-Ball E. P. Test, Kg. Load—Desired Properties		Viscosity in Centistokes—Desired Properties		
	Vol. Percent Diester	Vol. Percent Complex Ester		Seiz., 70 (min.)	Weld, 120 (min.)	At 210° F., 3.0 (min.)	At 100° F., 11.0 (min.)	At −65° F., 14,500 (max.)
1	100	0	0	55	100	3.31	12.54	8,450
2	100	0	5	70	100	3.33	12.84	14,420
3	100	0	10	85	100	3.32	13.15	17,368
4	95	5	0			3.6		10,800
5	95	5	3	80	120	3.6		13,000
6	95	5	5	85	120	3.6		13,800
7	90	10	0	60	140	3.8		12,500
8	90	10	3			3.8		13,900
9	90	10	5	95	140	3.8		16,200
10	65	35	0	60	140	5.2		33,000
11	0	100	0	65	140	10.26	53.6	Solid

A third series of lubricating compositions were prepared using as a base oil a di-C_7 Oxo adipate. Combinations of this base oil with the complex ester and tricresyl phosphate show an outstanding advantage for the use of the compositions of this invention. The data are reported in Table III below:

TABLE III

Physical data on synthetic oil composition

[Base oil—C_7 Oxo adipate.]

Lubricant No.	Makeup of Ester Blend		Wt. Percent Tricresyl Phosphate	Shell 4-Ball E. P. Test, Kg. Load—Desired Properties		Viscosity in Centistokes—Desired Properties		
	Vol. Percent Diester	Vol. Percent Complex Ester		Seiz., 70 (min.)	Weld, 120 (min.)	At 210° F., 3.0 (min.)	At 100° F., 11.0 (min.)	At −65° F., 14,500 (max.)
1	100	0	0	40	100	2.3	----------	2,290
2	100	0	10	70	100	----------	----------	----------
3	95	5	5	80	120	3.1	----------	4,100
4	90	10	5	50	130	2.8	----------	4,800

The lubricating compositions of the instant invention have been found to be compatible with additive materials that are useful to enhance certain properties of a lubricant. For instance, it has been found that certain oxidation inhibitors such as polynuclear phenols, alkylated phenols, phenothiazine, alkylated phenothiazine, etc., enhance oxidation stability of the base oil when incorporated in amounts varying from about 0.1 to 2.0 weight percent. Detergent inhibitors such as petroleum sulfonates, or metallic salts of petroleum sulfonates, such as the sodium, zinc, magnesium, barium salts, etc., may also be blended with the base composition. These inhibitors are found to be most advantageous in amounts varying between about 0.1 to about 5.0 weight percent. Rust inhibitors such as the polyhydroxy esters, represented by sorbitan monooleate and pentaerythritol monooleate, may be blended into the finished composition in amounts varying between 0.1 and 5.0 weight percent. From 0.1 to 2.0 weight percent of lecithin may be added as a corrosion inhibitor. Foam depressants such as silicone fluids may be added in amounts up to about 0.1 weight percent.

The compositions of invention may also be fortified against a tendency to cause rusting by incorporation of minor amounts of mineral oil. From about 5.0 to about 15.0 weight percent may be added to the finished oil to accomplish this.

To summarize briefly, this invention has as its object lubricating oil compositions which have outstanding properties at both high and low temperatures and have extreme pressure-resisting characteristics which make them especially suitable for use in jet engines. These new lubricating compositions are prepared by blending within certain specific limits (1) an ester of a dibasic acid in which the esterifying alcohol is of a branched chain configuration and contains from 6 to 16 carbon atoms, (2) a complex ester formed by the interaction of a glycol, a dibasic acid, and a branched chain alcohol having from 6 to 16 carbon atoms, and (3) tricresyl phosphate. It is within the concept of this invention to add to the blended lubricant other materials such as phenothiazine, viscosity index improvers, pour point depressants, other extreme pressure resistants, detergent inhibitors, oxidation inhibitors, rust inhibitors, sludge dispersants, etc. In the preferred embodiment of this invention, from 95% to 85% by volume of the diester is blended with from 5% to 15% by volume of the complex ester, and from 98% to 90% by weight of this blend is mixed with from 2% to 10% by weight of tricresyl phosphate. Especially preferred as the esterifying alcohols for both the diester and the complex ester are the alcohols produced from the Oxo process. Especially preferred is a blend of from 85% to 95% by volume of a C_7 or C_8 branched chain alcohol ester of a dibasic acid with from 5% to 15% by volume of a complex ester formed by reacting 2 mols of a half ester of adipic or sebacic acid, and 2-ethylhexyl alcohol with one mol of a polyethylene glycol having a molecular weight of about 200, about 98% to 90% by weight of this blend being mixed with from 2% to 10% by weight of tricresyl phosphate.

This case is a continuation of U.S. Serial No. 316,732 filed October 24, 1952, now abandoned, for the same inventors.

What is claimed is:

1. A synthetic lubricating composition suitable for the lubrication of moving parts of combustion turbines in aircraft engines over a range of temperatures of from about 450° F. to about −65° F. under conditions of extreme pressure which comprises a synergestic mixture of about 2.0 to 10.0 percent by weight of tricresyl phosphate and from 98.0 to 90.0 percent by weight of a blend of esters, said blend of esters consisting essentially of from 90.0 to 95.0 percent by volume of a diester and from about 10.0 to 5.0 percent by volume of a complex ester, said diester being formed by esterifying a branched chain alcohol with a dibasic acid selected from the group consisting of sebacic and adipic acids and said complex ester being formed by esterifying 1 mol of a polyethylene glycol having a molecular weight of about 200 with 2 mols of a half ester of sebacic acid and 2-ethyl hexanol, the numerical ratio of the vol. percent of said complex ester in said blend to the wt. percent of said tricresyl phosphate in said composition is in the ratio of 1:1 to 2.5:1.

2. A synthetic lubricating composition according to claim 1 wherein said diester is formed by esterifying 1 mol of the adipic acid with 2 mols of a mixture of isomeric primary branched chain alcohols having 8 carbon atoms, said mixture of alcohols having been prepared by subjecting an olefin having 7 carbon atoms to the action of carbon monoxide and hydrogen in the presence of a carbonylation catalyst at a temperature of about 300° F. to about 400° F. and a pressure of about 1000 to about 3000 pounds per square inch.

3. A synthetic lubricating composition according to claim 1 wherein said diester is formed by esterifying 1 mol of sebacic acid with 2 mols of 2-ethyl hexanol.

4. A synthetic lubricating composition suitable for the lubrication of moving parts of combustion turbines in aircraft engines over a range of temperatures of from about 450° F. to about −65° F. under conditions of extreme pressure which comprises a synergistic mixture of about 5.0 wt. percent of tricresyl phosphate and about 95.0 wt. percent of a blend of esters, said blend consisting essentially of 95.0 vol. percent of a diester formed by esterifying 1 mol of adipic acid with 2 mols of a mixture of isomeric primary branched chain alcohols having 8 carbon atoms, said mixture of alcohols having been prepared by subjecting an olefin having 7 carbon atoms to the action of carbon monoxide and hydrogen in the presence of a carbonylation catalyst at a temperature of about 300° F. to about 400° F. and a pressure of about 1000 to about 3000 pounds per square inch, and 5.0 vol. percent of a complex ester, said complex ester having been prepared by esterifying 1 mol of a polyethylene

glycol having a molecular weight of about 200 with 2 mols of a half ester of sebacic acid and 2-ethyl hexanol.

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